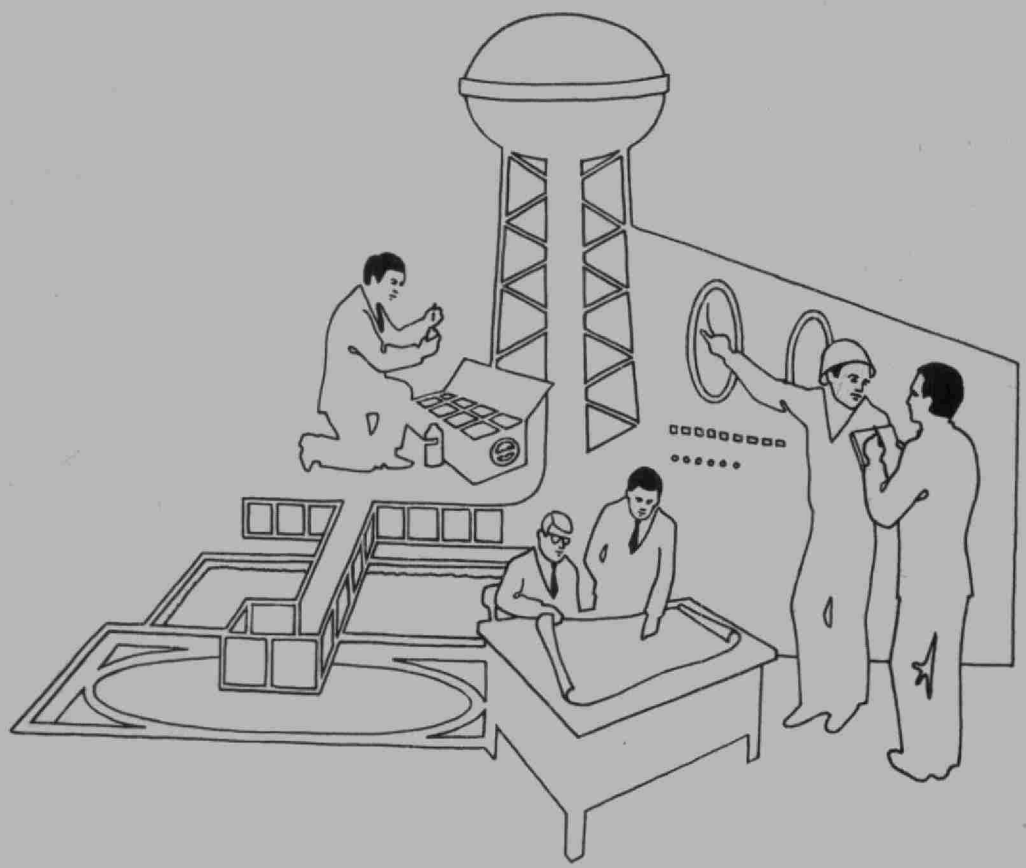
Water management in Ontario

Ontario Water Resources Commission

District Engineers Branch



IMPROVEMENT DISTRICT OF WHITE RIVER

District of Algoma

WATER POLLUTION SURVEY OF WHITE RIVER

July 16, 1970

DISTRICT ENGINEERS BRANCH - FIELD INVESTIGATIONS

MUNICIPALITY - IMPROVEMENT DISTRICT OF WHITE RIVER
District of Algoma

DATE - July 16, 1970

MATTER INVESTIGATED - WATER POLLUTION SURVEY OF WHITE RIVER

REPORT BY - B. D. Howieson
Civil Technologist

AT REQUEST OF - Special

DISTRIBUTION OF REPORT -

Canadian Pacific Railway
Schreiber, Ontario
Att: Mr. F. J. Koehn
Superintendent

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Secretary-Treasurer
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White River, Ontario

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Central Records

Regional File

District File

NO.	DATE PREPARED	DATE TYPED	TYPED BY	DATE APPROVED	DATE MAILED
	Nov. 17, 1970	Nov. 20, 1970	:sn	Nov. 24, 1970	Nov. 25, 1970

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REPORT

Ontario Water Resources Commission

Municipality IMPROVEMENT DISTRICT OF WHITE RIVER District of Algoma Date of Inspection July 16, 1970

Re: WATER POLLUTION SURVEY OF WHITE RIVER

Field Inspection by B.D. Howieson, Civil Technologist Report by B. D. Howieson

INTRODUCTION

On July 16, 1970, a water pollution survey of the White River, in the immediate vicinity of the town of White River was conducted by Mr. B. Howieson, OWRC Technologist. Furthermore, during the few months prior and subsequent to this survey, a continuous municipal sanitary study of the town proper was carried out, with the pertinent information being compiled and finalized quite recently.

The study involved interviews with permanent residents of the area and periodic dye testing of waste disposal systems, in an attempt to determine the town's existing collection system(s), to locate major waste outfalls and finally to obtain a clear overall picture of the municipality's present waste treatment methods. At the time of the water pollution survey, monitoring stations were established and chemical and bacteriological sampling of the watercourse undertaken.

The purpose of this report is three-fold; namely, to outline the town's existing waste treatment facilities; sources of major waste discharges to this watercourse and the resulting impairment that these waste discharges are exerting on this watercourse; and finally to present corrective measures available to ameloriate the overall precarious situation respecting inadequate waste treatment in this municipality.

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A schematic plan of the area, outlining the monitoring stations and any pertinent information relating to the survey has been attached for reference (Appendix 1).

GENERAL

In 1969, the assessed population of the Improvement District of White River was 1,012*. It is estimated that virtually the entire population resides within the limits of the town proper.

Originally, the town was designed to facilitate Canadian Pacific Railway operations and would comprise mainly what is known as the present "downtown area". In the past few years, the town has expanded, especially along the Trans-Canada Highway and recently within the last year or so became incorporated. However, it would appear that currently a considerable portion of the town is still being developed by the C.P.R. and consequently the majority of key services are provided by the railway. In addition, it has been expressed that the railway still maintains virtual ownership of the property in the downtown area.

Following interviews with permanent residents in this area, it was ascertained that domestic and commercial wastes by and large are disposed of on an individual basis by either septic tank or cesspool type facilities. However, it was noted that in a few instances, in the downtown section especially, a small number of services utilize a communal septic tank arrangement.

Over the past few years, it has been shown by various physical characteristics, i.e. effluent ponding, that generally septic tank-field tile systems do not function adequately in this immediate area. It is felt that in all likelihood, this occurrence is more evident in areas of shallow

* 1970 Municipal Director

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overburden but is still predominantly experienced over the entire town and is probably due to the muskeg-clay nature of the area's stratum.

At present, the municipality is not served by any organized health agency nor does it provide its own health services.

OBSERVATIONS

(i) Water Pollution Survey

At this time, the level of the watercourse appeared to be a few feet lower than normal and the flow was minimal. It is estimated that in this reach of the river, the average depth would be approximately 6-10 feet. It is accepted that there is no significant development bordering this watercourse upstream from the town and consequently it is felt that no unnatural waste contributions to the stream would be evident above the town.

During the survey, numerous submerged pipes of various sizes and types terminating in the stream were noted. Furthermore, as the appended plan illustrates, three major outfalls were observed and in the immediate area of each, characteristics of domestic waste discharges, i.e. smell, floating scum, greyish sludge blanket, were imminent. It was later determined that at least one of these three outfalls is a combined sewer and consequently transports storm flow as well as domestic wastes to the river during rainstorms and spring run off periods of the year. Furthermore, a number of smaller pipes were noted at various locations along the stream and were later identified as outfalls to waste disposal systems. Although not widespread, isolated pools of oil were observed and in all likelihood are the result of poor railway fueling operations along the bank of the stream.

Generally, no visible signs of gross impairment were evident in the river further downstream from the town, although the stream itself appeared to be more heavily saturated with aquatic rooted plants, possibly resulting from increased enrichment.

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(ii) Municipal Sanitary Survey

As stated earlier, waste disposal in this municipality is virtually effected by means of septic tank or cesspool type operation.

In the immediate downtown area, communal septic tank systems are prevalent. Although numerous cases exist where two or three houses share a common septic tank, only three main areas were noted as being served by a communal waste treatment system of considerable size. Furthermore, it was established that these systems and other smaller type systems involve a network of piping which ultimately drains to the White River.

Outside the immediate downtown area, cesspools are more prevalent, although some homes utilize septic tanks. It has been observed that often, more than one cesspool is utilized by a single dwelling home and viewing the appearance of these various type facilities would indicate their inadequacy respecting safe sanitary operation. It is noted that for the majority of these waste treatment facilities, no formal health agency approval has ever been given.

In addition, it would appear that several homes bordering a land depression to the north of the downtown section, discharge their septic tank effluent directly to this area. A review of the topography of this area and a site inspection establishes that natural drainage from this area to Little Lake, located just north of the Trans-Canada Highway, seems feasible. It should be noted that Little Lake discharges into Little Lake Creek which ultimately drains into the White River at a point several miles downstream from the town.

As previously mentioned, the area bordering both sides of the Trans-Canada Highway has been developing quite significantly over the last few years. During the study, a site inspection of the various establishments revealed that virtually all the domestic and commercial wastes undergo treatment in septic

tank-field tile systems on an individual basis and that the majority of these systems were operating satisfactorily at that time. However, it was established by dye tests that one major system lacked a field-tile bed and that the septic tank effluent was gaining access to the previously mentioned depression area located at the rear of the facility.

Generally, it is apparent that a large number of residences adjacent to this depression area discharge their septic effluent to same. It is felt that possibly other establishments along the highway discharge wastes to this same area. It has been noted during this study that many forms of garbage are also deposited here and certainly represent an unhealthy situation.

WATER QUALITY ANALYSES AND RESULTS

During the survey, five monitoring stations were selected and were designated W-1 ... W-5, as the appended plan illustrates. At each of these five stations, chemical and bacteriological samples of water were collected from the river. In addition, a dissolved oxygen test was carried out at each station and any other pertinent useful data, i.e. temperature, physical characteristics were recorded. Refer to Appendix 2 (a) and (b).

The bacteriological and chemical results of the analyses carried out on the first set of stream water samples collected are also appended. The parameters utilized in this survey to measure the level of pollutants in this watercourse were BOD_5, suspended solids, nitrogen and phosphorus concentrations as well as total coliform organisms/100 ml and use of each parameter has been appended. (Appendix 3). In addition a chemical sample of the effluent from two of the three major outfalls was collected and analyzed using the same parameters as a guideline. An additional chemical and bacteriological sample was collected from outfall #2 during October, 1970, and these results have been appended also.

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The chemical results of the samples collected from the five monitoring stations during this survey indicated that enrichment of this reach of the watercourse was occurring. A graph illustrating an increase in the concentration of each of the nutrient parameters (total and soluble phosphorus and Total Kjeldahl) and the suspended solids, following the successive waste inputs from outfalls #1, 2 and 3) has been appended, Appendix 4.

The chemical results of the samples collected from station W-1 clearly demonstrate an unusually high concentration for most of the parameters measured. It is felt that these results do not adequately reflect the stream's natural water quality. The fact that this monitoring station is in close proximity to the local public bathing beach would apparently have affected the natural concentration(s) of certain parameters. Nevertheless, the chemical results of the samples collected from stations W-2, W-3 and W-4 illustrate slight adverse changes in the stream's water quality probably owing to the build up from successive waste inputs originating at each of the town's outfalls. Refer to Appendix 4.

Clearly, the concentration of the various parameters measured in the waste samples collected from the two outfalls on both occasions, exemplify the potential impairment of this watercourse arising from these deleterious waste discharges. During the survey, dissolved oxygen tests were conducted at each of the five monitoring stations and a graph of same has been appended, Appendix 2(b). Again, clearly from these tests, it is shown that in the area of these waste discharges, an oxygen sag or depletion was occurring and in all likelihood was the result of the input of oxygen demanding domestic wastes.

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It should be noted that the concentration of pollutants in the outfall waste samples, collected to date generally exceed the OWRC objectives set down for satisfactory waste effluents being discharged to a watercourse.

Of special interest are the nitrogen and phosphorous concentrations of the outfall waste samples. It is generally accepted that concentrations of this magnitude for both parameters would significantly promote the production of aquatic plants and could also represent a significant instrument in the aging process of the stream. In addition to the dissolved oxygen tests, certain physical characteristics of the stream were noted and recorded. Refer to Appendix 2(a). It is important to realize that plant growth build-up was observed at each successive station and may be due in part at least to the enrichment process resulting from the excessive concentrations of phosphorous and nitrogen in the domestic waste discharges to the watercourse.

The results of the bacteriological samples collected from the monitoring stations and examined, indicated a coliform concentration greatly in excess of the Commission's objective of 1000 total coliforms per 100 ml for safe recreational activity. In addition, the bacteriological results of the sample collected from Outfall #2 showed a faecal organism concentration typical of domestic raw sewage and/or an excretal source.

CONCLUSIONS

On the basis of the information observations and sample results compiled to date, it appears that some impairment to this particular reach of the river is occurring as a result of deleterious waste discharges. It is felt that the impairment of this watercourse realized to date can be substantiated by the increase in nutrient concentrations, the dissolved oxygen depletion and the general physical characteristics noted during this survey and exemplified by the sample results.

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It is further felt that if a detailed study involving frequent composited chemical sampling, bacteriological sampling, controlled field tests and site observations from a physical and biological standpoint were undertaken over a long term, the full impairment effect on this stream as a result of the town's present waste input, would be more apparent. Nevertheless, it should be ostensible that as the town continues to grow, in all likelihood the town's waste input to the river will significantly increase and the overall result will be serious impairment of this watercourse. It would appear at present that the assimilation capacity of this stream tends to diminish the overall effect of the town's waste discharges. Nevertheless, it has been established, by this survey, that the impairment of the watercourse, although slight, can be measured and observed and would indicate the necessity of adopting corrective measures to abate further pollution.

The results of the bacteriological samples collected from the stream upon examination, demonstrated that the quality of the water over that reach of the river was extremely poor. Furthermore, these results in all cases exceeded the OWRC limit of 1000 coliforms per 100 ml considered the maximum concentration allowed in a water area used for recreational purposes.

On numerous occasions, it has been observed that the effluent from domestic and commercial septic tank systems drain to a depression area located in the north section of town. It has been postulated that eventually this area drains to the lake located on the north side of the Trans-Canada Highway. It would seem feasible that this "depression" area could represent a repository of all forms of waste during the major portion of the year and that during heavy rain periods, i.e. spring, these accumulated wastes could be transported to Little Lake in the form of a shock loading and could seriously impair the quality of this watercourse. Although it could possibly be established that a

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slight degree of impairment to Little Lake is resulting from these waste discharges of all forms, i.e. sewage, garbage, it seems more critical from a health standpoint that some unfortunate situation, i.e. epidemic, could arise in view of these unsanitary practises. On the basis of both these facts and the fact that this area is frequented by children, it is concluded that these present practises should be discontinued immediately.

In final conclusion, it would appear that the present mode of waste treatment in this municipality is inadequate and is unable to be solved on an individual basis, as past experience has demonstrated. Consequently, it would appear that waste treatment for the town to be effective, will have to be undertaken collectively.

RECOMMENDATIONS

The following recommendations are respectfully presented for consideration:

(1) Municipality should retain the Algoma Health Unit to provide medical services.

(2) A comprehensive (door-to-door) sanitary survey should be completed and any unsanitary practises as noted in the body of the report be discontinued.

(3) Individual waste disposal systems should be corrected from both a pollution and health standpoint on a temporary basis until more adequate sewage facilities are provided.

(4) Municipality should retain the services of a firm of consulting engineers to study and report on the town's present and future waste treatment requirements.

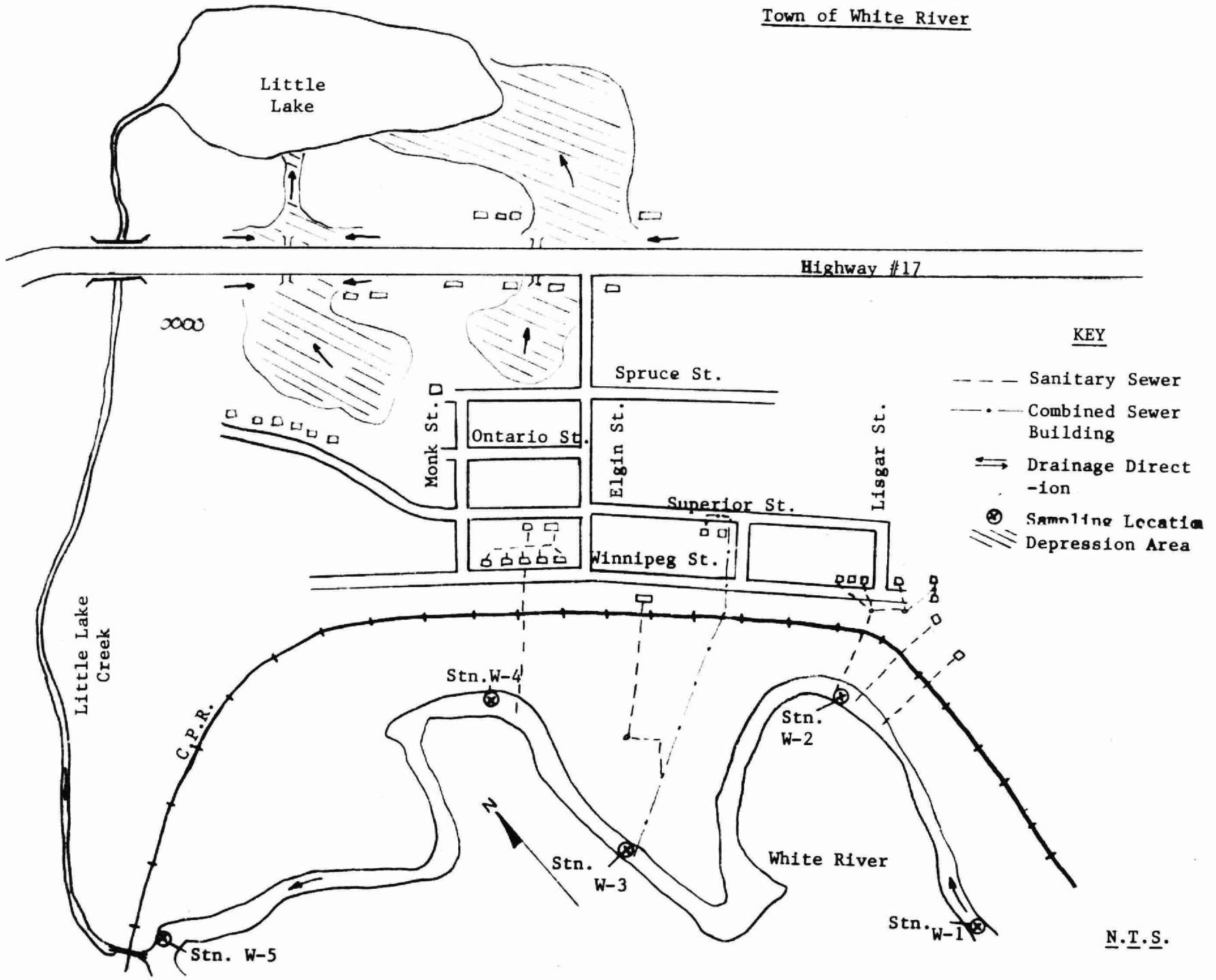
Prepared by: B Howieson

BDH:sn

B. D. Howieson
Civil Technologist
Division of Sanitary Engineering

Appendix 1

Schematic Plan of
Town of White River



N.T.S.

APPENDIX 2(a)

STATION	DISSOLVED OXYGEN CONCENTRATION (ppm)	TEMPERATURE ^{O}F
W-1	8	17.0
W-2	8	17.5
W-3	4	17.5
W-4	6	17.5
W-5	7	17.0

LOCATION AND OBSERVATIONS (Physical Characteristics)

Generally, river has a highly coloured medium (reddish brown), shallow on this reach and relatively stagnant.

STATIONS

W-1 is located adjacent to local public bathing beach, stream deep, minimum turbidity, considerably aquatic plant growth.

W-2 located opposite Lisgar St., stream shallow, quite turbid, no appreciable aquatic plant growth, piles of scum and debris on shoreline.

W-3 located opposite C.P.R. station, stream shallow, extremely turbid, considerable aquatic plant growth, evidence of septicity on shoreline, stream stagnant, plume of waste output apparent.

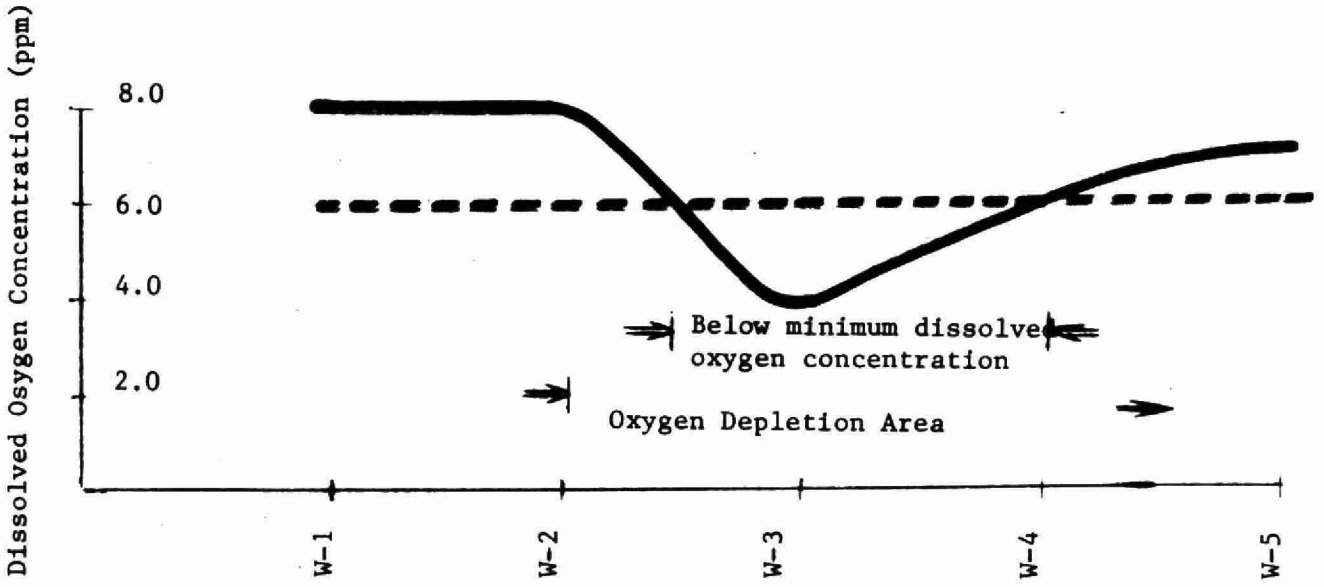
W-4 located as indicated on the schematic plan, stream deeper, water still quite turbidy, significant weed growth, evidence of septicity in immediate area of waste outfall.

W-5 located at junction of the White River and the Little Lake Creek, stream very deep and wide, similar to W-1, no physical signs of domestic wastes.

APPENDIX 2(b)

GRAPH OF D.O. CONCENTRATION V.S.

MONITORING STATION



Minimum acceptable D.O. Concentration in natural waters for

(1) normal uses 6.0 ppm

(2) spawning areas 7.0 ppm

APPENDIX 3

DEFINITION OF PARAMETERS

Bacteriological Examination

The presence of coliforms indicates pollution from human or animal excrement, or from some non-faecal forms. The objectives for surface water quality in Ontario is a maximum of 1000 organisms per 100 millilitres.

The OWRC Laboratories employ the Membrane Filter (MF) technique of examination to obtain a direct enumeration of coliform organisms. The Department of Health Laboratories use the Most Probably Number (MPN) ennumeration and coliform counts are reported as Total Coliform Organisms (TC) and Faecal Coliform Organisms (FC).

Biochemical Oxygen Demand (B.O.D.)

Biochemical Oxygen Demand is reported in parts per million (PPM) and is an indication of the amount of oxygen required for the stabilization of decomposable organic or chemical matter in water. The completion of the laboratory test required five days, under controlled incubation temperature of 20^{o} Centigrade.

The OWRC objective for surface water quality is an upper limit of four (4) ppm.

Solids

The value for solids, expressed in parts per million, is the sum of the values for the suspended and the dissolved matter in the water. The concentration of suspended solids is generally the most significant of the solids analyses with regard to surface water quality. The effects of suspended solids in water are reflected in difficulties associated with water purification, decomposition in streams and injury to the habitat of fish.

Nitrogen

Ammonia Nitrogen or sometimes called free ammonia, is the insoluble product in the decomposition of nitrogenous organic matter. It is also formed when nitrates and nitrites are reduced to ammonia either biologically or chemically. Some overall amounts of ammonia, too, may be swept out of the atmosphere by rain water.

The following values may be of general significance in appraising free ammonia content: Low 0.015 to 0.03 ppm: moderate 0.03 to 1.10 ppm : high 0.10 or greater.

Total Kjeldahl is a measure of the total nitrogenous matter present except that measured as nitrite and nitrate nitrogens. The Total Kjeldahl less the Ammonia Nitrogen measures the organic nitrogen present. Ammonia and organic nitrogen determinations are important in determining the availability of nitrogen for biological utilization. The normal range for Total Kjeldahl would be 0.1 to 0.5 ppm.

Nitrite Nitrogen

Nitrite is usually an intermediate oxidation of ammonia. The significance of nitrites, therefore, varies with their amount, sources and relation to other constituents of the sample, notably, the relative magnitude of ammonia and nitrite present. Since nitrite is rapidly and easily converted to nitrate, its presence in concentrations greater than a few thousandths of a part per million is generally indicative of active biological processes in the water.

Nitrate Nitrogen

Nitrate is the end produce of aerobic decomposition of nitrogenous matter, and its presence carries this significance. Nitrate concentration is of particular interest in relation to the other forms of nitrogen that may be present in the sample. Nitrates occur in the crust of the earth in many places and are a source of its fertility.

The following ranges in concentration may be used as a guide: low, less than 0.1 ppm: moderate, 0.1 to 1.0 ppm: high, greater than 1.0 ppm.

Anionic Detergents as ABS

The presence of anionic detergents as ABS is an indication that domestic waste is present.

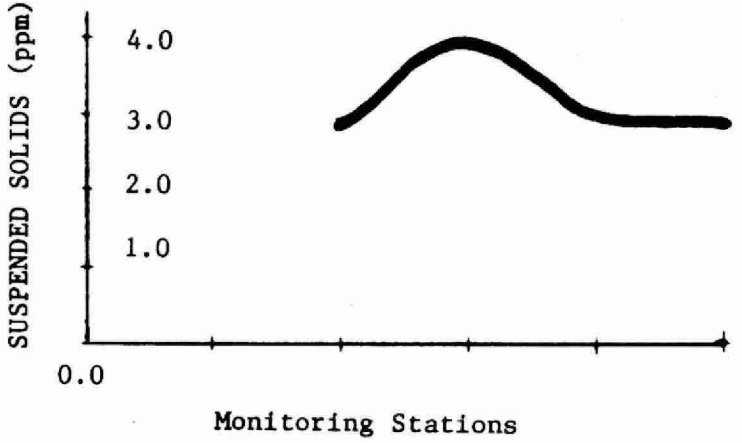
Phosphorus

Phosphorus also is a by-product of the decomposition of organic wastes and, in addition, may occur in considerable quantities in industrial wastes and land drainage. It serves as an important nutrient and if present in excessive amounts, may cause the development of profuse growth of aquatic plants which may interfere with the normal uses of water such as water supply and stock watering. The normal amount of phosphorus as PO_4 in water is approximately 0.01 ppm.

APPENDIX 4

PARAMETER CONCENTRATION(S) VERSUS MONITORING STATIONS

(a)



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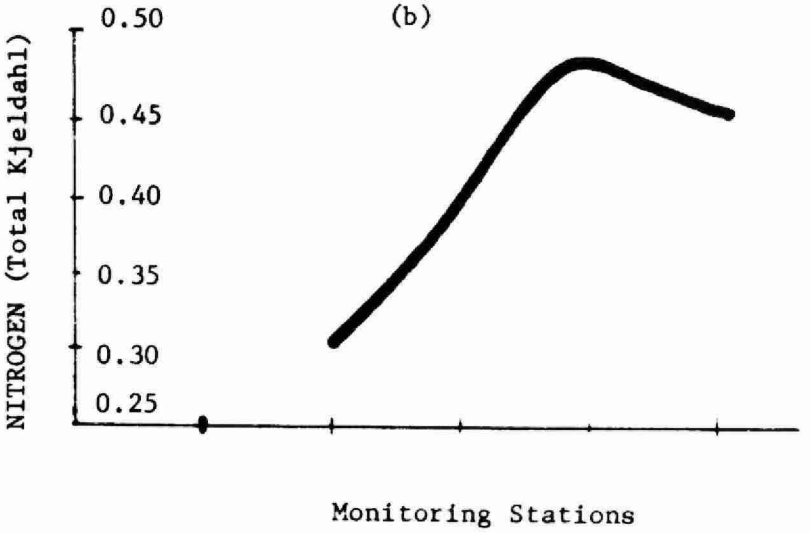

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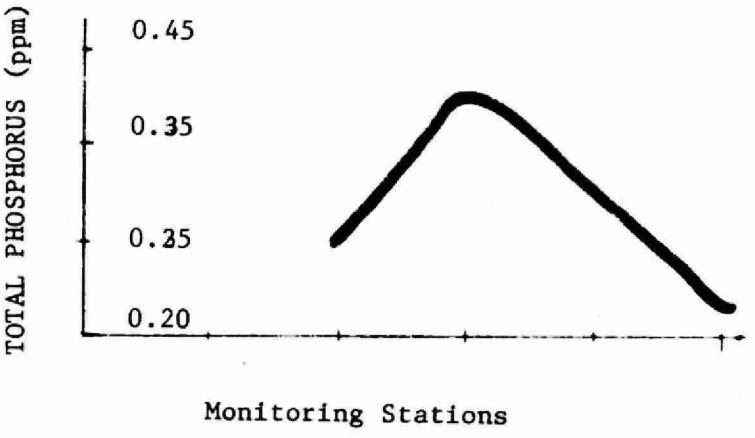
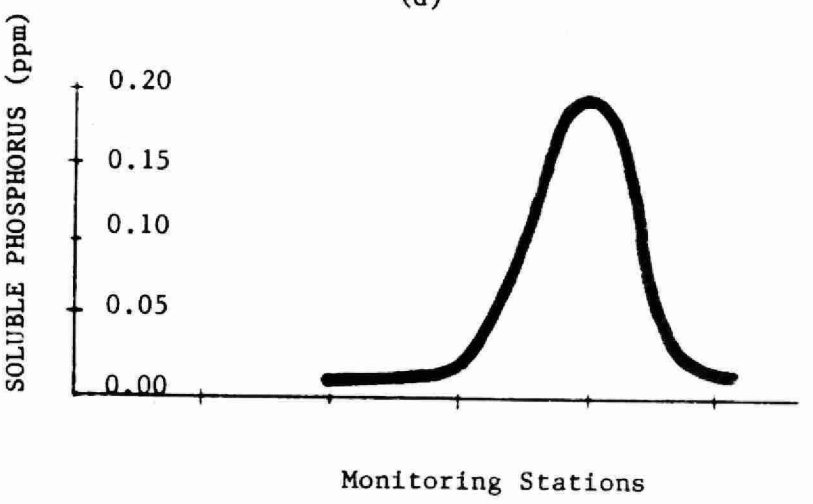


(d)



ONTARIO WATER RESOURCES COMMISSION

CHEMICAL LABORATORIES

All analyses except pH reported in p.p.m. unless otherwise indicated

SEWAGE ANALYSES

1 p.p.m. = 1 mgm. / litre = 1 lb. / 100,000 Imp. Gals.

Municipality: I.D. of White River

Report to: Division of Sanitary Engineering
Thunder Bay Regional Office

c.c.

Source: Storm Drain

:sn

Date Sampled: Oct. 15/70 by: H. Weickert

Lab. No.	5-day B.O.D.	SOLIDS			Anionic Detergents as ABS		BACTERIOLOGICAL EXAMINATION					
		Total	Susp.	Diss.			Lab. No.	Faecal Coliforms	Coliform Bacteria			
658	112	262	53	209	5.6		1 2741	2200000	56000000			

658 Outfall #2 - combined sewer

1 2741 Town drain at edge of C.P.R. property (upstream) - Winnipeg Avenue (Outfall #2 - combined sewer)

5M 60 31784

ONTARIO WATER RESOURCES COMMISSION
CHEMICAL LABORATORIES

All analyses except pH reported in p.p.m. unless otherwise indicated

RIVER SURVEY

1 p.p.m. = 1 mgm. / litre = 1 lb. / 100,000 Imp. Gals.

Municipality: I.D. of White River Report to: J.R. Marsh - OWRC, Thunder Bay Regional Office c.c.

Source: White River - as noted below

:sn

Date Sampled: July 16, 1970 by: B. D. Howieson

Lab. No.	Sample Point No.	5-Day B.O.D.	SOLIDS Susp.	PHOSPHORUS AS P* Total	Soluble	NITROGEN AS N Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	BACTERIOLOGICAL EXAMINATION Lab. No.	Coliform Bacteria
R727	1	1.6	7	**	.10	.00	.38	.003	.01	1 1815	9700
R728	2	1.8	3	.025	.008	.00	.30	.003	.01	1 1816	72000
R729	3	1.4	4	.040	.014	.00	.39	.003	.01	1 1817	3900
R730	4	1.5	3	**	.20	.00	.48	.003	.01	1 1818	7600
R731	5	0.8	3	.021	.007	.01	.46	.002	.01	1 1819	2900
R732	6	6.0	9	.22	.098	.66	1.7	.016	.10		
R733	7	150	74	32	30	28	34	.040	.01		

* Low values reliable to .002 ppm

** Sample Exhausted

R727 Station W-1 - above town

R728 Station W-2 - below first major outfall

R729 Station W-3 = below second major outfall

R730 Station W-4 - below third major outfall

R731 Station W-5 - near junction of White River and Little Lake Creek below town - near Station 3

R732 - Sample taken from outfall #2

R733 - Sample taken from outfall #3

1 1815 Station #1 - above town

1 1816 Station #2 - below first major outfall

1 1817 Station #3 - below second major outfall

1 1818 Station #4 - below third major outfall

1 1819 Station #5 - near junction of White River and Little Lake Creek

5M-60-31784